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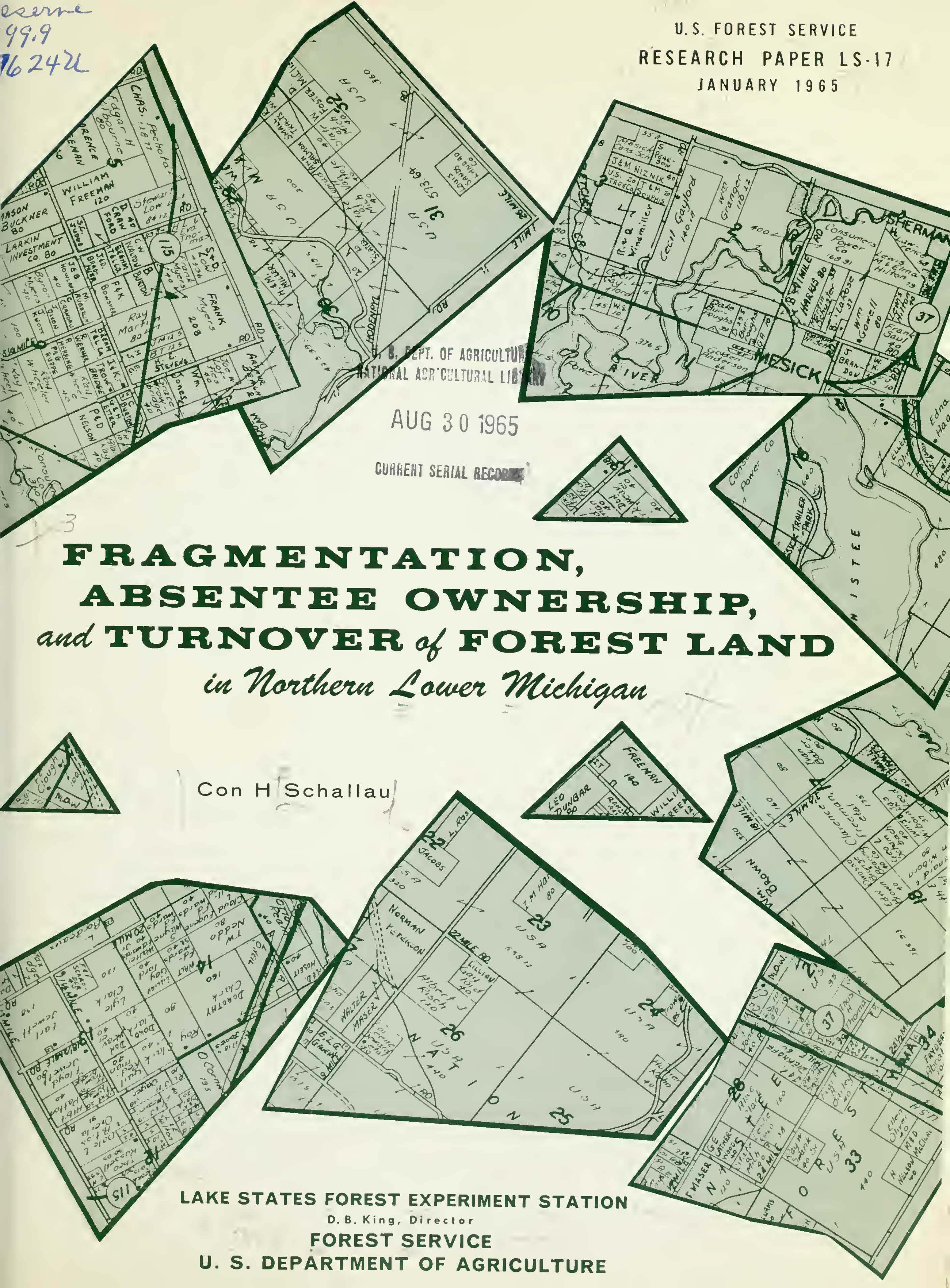

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FRAGMENTATION, ABSENTEE OWNERSHIP, and TURNOVER of FOREST LAND in Northern Lower Michigan

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Schallau, Con H.
1965. Fragmentation, absentee ownership, and turnover of forest land in northern Lower Michigan. Lake States Forest Expt. Sta., St. Paul, Minn. 12 pp., illus. (U.S. Forest Serv. Res. Paper LS-17)

This report examines three aspects of private forest ownership that could affect the economic availability of timber: size of tract, residence of owner, and turnover rate. Generally speaking, forest properties in northern Lower Michigan are getting smaller. Most postwar fragmentation was associated with the breakup of "large" holdings (i.e., those of more than 5,000 acres). The acreage of forest land owned by nonresidents increased 45 percent between 1946 and 1962. During the same period, turnover of forest properties was fairly rapid, with 60 percent of the ownerships changing hands at least once.

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The Problem

During the summer of 1962 I spent several weeks checking county tax records and plat books to determine the acreage of large ownerships (i.e., those of more than 5,000 acres) in Michigan. I found that a number of large ownerships, still in existence as late as 1954, had since been divided and sold.[1] These findings prompted the question, "Are Michigan's forest properties in general getting smaller?" On the other hand, consolidation of smaller properties might have compensated for the breakup of large properties.

Why be concerned about the size of forest properties? We'll explore the reasons a little later but one point of concern is that, theoretically, reducing the average size of tract would decrease the economic supply of timber, other things remaining constant. Of course, the reverse would be true if the size of forest properties increased.

Although the harvest of Michigan's timber can undoubtedly be increased, there's the question, "How much?" Until we have economic supply data we can only use the Forest Survey figures on physical supply. This study examines certain ownership changes and is part of an effort to estimate economic supply.

Study Highlights

Privately owned forest properties in the northern 31 counties of Lower Michigan are getting smaller. The average size of contiguous forest tracts in 1946 was 182 acres; in 1962 the average had dropped to 156 acres.[2] The breakup of large forest ownerships caused most of the reduction. In 1946 the average acreage of forest land within and contiguous to the sample sections chosen in this study was 979 acres. By 1962 it had dropped to 860 acres — a decrease of 119 acres. The reduction in large forest ownership acreage accounted for 64 percent of this difference, with medium and small properties accounting for the rest.

Most postwar fragmentation of forest land took place between 1946 and 1954. Several large ownerships were being divided during this period. Although fragmentation has been more gradual since, it is likely to continue.

Acreage of absentee ownership increased by 45 percent during the 1946-1962 period. Unlike fragmentation, most of which occurred shortly after World War II, absentee ownership continues to increase at a fairly steady rate. Also, absentee ownership increased uniformly throughout the study area, whereas fragmentation was more prevalent in the more heavily forested counties.

The high turnover of forest properties since World War II is apparent. Only 40 percent of the forest area had just one owner since 1946; 44 percent of the area had two owners, while 16 percent had three owners.

Forest survey data indicate that Michigan's physical supply of timber is increasing. But the increase in physical supply doesn't necessarily mean that more timber will be marketed. To accomplish the latter, owners must be willing to sell more timber at prices that buyers are willing to pay. Both buyer and seller decisions are bound to be affected by the ownership changes identified in this study.

Very likely, fragmentation and property turnover restrict the economic supply[3] of timber while absentee ownership could increase as well as decrease it. Further studies will be needed to show in what direction and how much supply is affected by these factors.

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[1] *Con H Schallau. Forest owners and timber management in Michigan, U.S. Forest Serv. Res. paper LS-9, 39 pp., illus. 1964 (See p. 20) Lake States Forest Expt. Sta., St. Paul, Minn.*

[2] *Definitions of "contiguous forest tract," "sample section," and "sizes of ownership" appear on pages 2 and 3.*

[3] *The physical supply of timber is the total volume in existence. Economic supply is a schedule showing quantities that would be marketed at various prices.*

Note: The author is an Economist on the staff of the Lake States Forest Experiment Station, which is maintained at St. Paul, Minn., by the Forest Service, U.S. Department of Agriculture, in cooperation with the University of Minnesota. Appreciation is expressed to personnel of county treasurer offices for their patience and assistance and to the U.S. Agricultural Stabilization and Conservation Service in Lansing, Mich., for the use of their aerial photos.

Private Ownership Predominates in Study Area

The area chosen for this study is the 31 northernmost counties of Lower Michigan (fig. 1). This area's 7.5 million acres of commercial forest cover 71 percent of its land surface. About two-thirds of the forest area is privately owned.

Pulpwood is rapidly becoming the mainstay of the study area's timber-using industry. Currently it accounts for slightly more than 50 percent of the total timber harvest. Output of pulpwood has shown a rapid increase during the past decade. In 1963, for instance, 494,000 cords of pulpwood were harvested, or about 126 percent above the 1954 level. This upward trend should continue. The fact that the timber base could support a higher cut is an encouragement for present mills to increase capacity and an attraction for new industries.

Northern Lower Michigan is sparsely populated. The 1960 Census showed only 5 percent of the State's 7.8 million people residing there. But its forests and lakes make it a vacationland for many Michigan and out-of-state residents.

334 Sample Sections Allocated to 16 Counties

To reduce travel time, the study was conducted in only 16 of the 31 counties of northern Michigan. These were randomly selected. Further, only half the townships in each county were sampled, here again for travel reasons. The basic sampling unit within each township was a 640-acre section; 334 sections, or approximately 2 percent of the study area's total acreage, were allocated among the counties in proportion to their land areas.

For analytical purposes the 16 counties were stratified into 5 zones according to forest density (see fig. 1 for location of counties):

Zone	*County*	*Percent forested*	*Number of sample sections*
1	Oceana, Osceola	40-55	41
2	Gladwin, Mason, Midland	56-65	55
3	Alpena, Charlevoix, Clare, Missaukee, Newaygo, Wexford	66-75	124
4	Cheboygan, Presque Isle	76-85	48
5	Alcona, Lake, Montmorency	86 plus	66
All zones		71	334

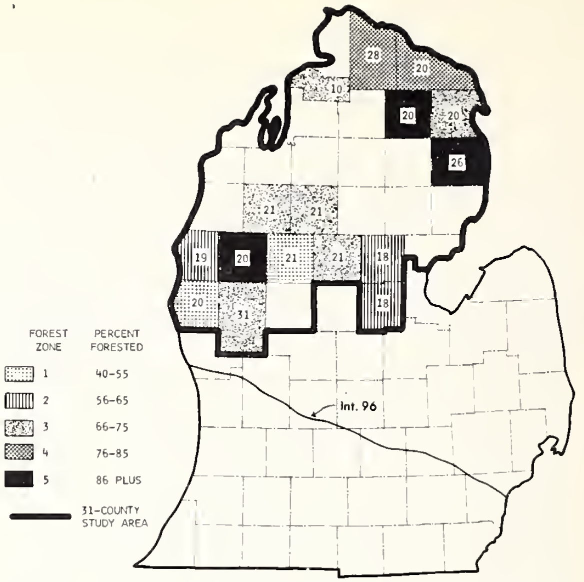

FIGURE 1. — Sixteen sample counties were selected randomly within the study area. A total of 334 sample sections, representing about 2 percent of the land area in the 31 counties were allocated in proportion to the land areas of the counties. The numbers indicate how many sample sections were allocated to each county.

Area Within and Contiguous To Sample Sections Used to Measure Changes in Tract Size

Change in size of forest tracts can be measured in several ways. Trends in large ownership acreage is one way but such trends provide only partial checks. Change could also be measured by counting the number of properties at various points in time. But as shown in figure 2, number of properties alone could lead to false conclusions. One might conclude that only fragmentation had occurred in instances where consolidation was just as important.

I tabulated the number of forested properties at three points in time: 1946, 1954, and 1962 (see figure 3 for technique used). I also measured forest area in each sample section, and *in addition,* forest land "contiguous to" the sample section and owned by individuals having property in the sample section. My objective in this phase of the study was to measure the breakup and the consolidation of forest properties, and this sampling scheme allows for the fact that individual properties

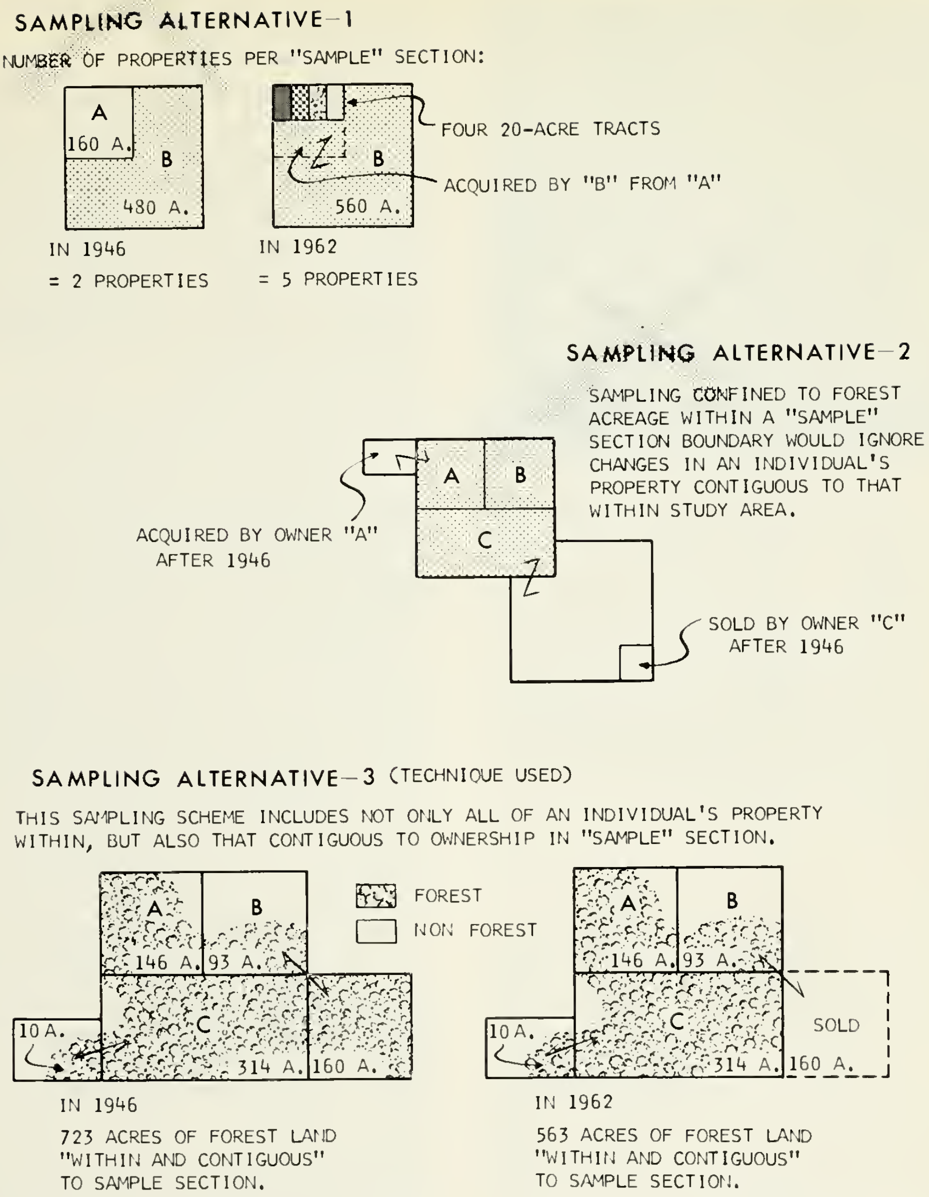
SAMPLING ALTERNATIVE—1
NUMBER OF PROPERTIES PER "SAMPLE" SECTION:
A
160 A.
B
480 A.
IN 1946
= 2 PROPERTIES
B
560 A.
FOUR 20-ACRE TRACTS
ACQUIRED BY "B" FROM "A"
IN 1962
= 5 PROPERTIES
SAMPLING ALTERNATIVE—2
SAMPLING CONFINED TO FOREST ACREAGE WITHIN A "SAMPLE" SECTION BOUNDARY WOULD IGNORE CHANGES IN AN INDIVIDUAL'S PROPERTY CONTIGUOUS TO THAT WITHIN STUDY AREA.
A
B
C
ACQUIRED BY OWNER "A" AFTER 1946
SOLD BY OWNER "C" AFTER 1946
SAMPLING ALTERNATIVE—3 (TECHNIQUE USED)
THIS SAMPLING SCHEME INCLUDES NOT ONLY ALL OF AN INDIVIDUAL'S PROPERTY WITHIN, BUT ALSO THAT CONTIGUOUS TO OWNERSHIP IN "SAMPLE" SECTION.
A
146 A.
B
93 A.
C
314 A.
10 A.
160 A.
FOREST
NON FOREST
IN 1946
723 ACRES OF FOREST LAND "WITHIN AND CONTIGUOUS" TO SAMPLE SECTION.
A
146 A.
B
93 A.
C
314 A.
10 A.
SOLD
160 A.
IN 1962
563 ACRES OF FOREST LAND "WITHIN AND CONTIGUOUS" TO SAMPLE SECTION.

FIGURE 2. — Breakup or consolidation of forest properties cannot be measured by merely counting the number of properties in a sample (alternative 1). Such a technique could conceivably suggest sizable changes toward fragmentation when, in effect, consolidation might be as great or greater. One improvement is to measure forest area as well as the number of tracts (alternative 2), but even here the results might be misleading unless entire ownerships are considered. Alternative 3 does this and, therefore, allows for properties that overlap section lines.

frequently overlap section lines.

For easy reference I will be using the terms contiguous forest "block," and contiguous forest "tract"; a block is merely an aggregation of tracts. As figure 4 shows, both the forest tract and forest block can include area outside, but adjacent to, a sample section. If an individual has only a single stand of timber, then the size of his contiguous forest tract is the same as "total forest area owned." However, for individuals having other scattered tracts of timber not adjacent to the sample section, this is not true.

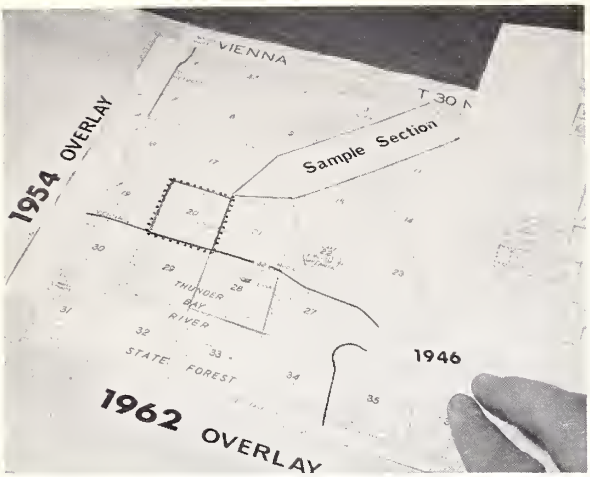

FIGURE 3. — County plat books provided base maps for this study. Tax rolls were checked for the years 1946, 1954, and 1962. Three vellum overlays, one for each year, were attached to a base map. Differences in parcel size and property owner between the plat book and tax rolls were sketched on the overlays. Owner's place of residence was also indicated. Forest acreages for contiguous tracts were determined from aerial photos and noted on base maps. Then, all of this information was coded on sample section summary sheets.

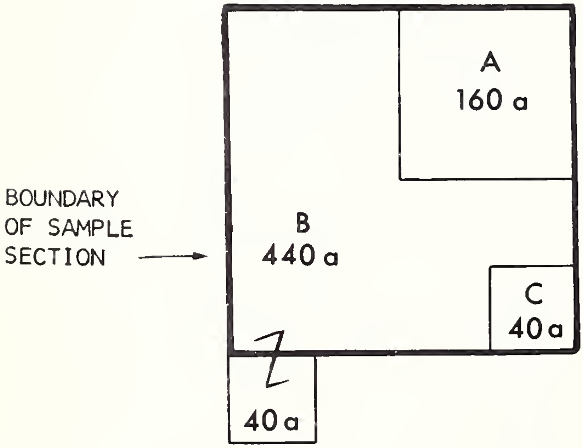

FIGURE 4. — The size of this contiguous forest block is 680 acres, of which 640 acres are within and 40 acres are contiguous to the sample section. This forest block is composed of three contiguous forest tracts: A, 160 acres; B, 480 acres; and C, 40 acres.

Trend Was Toward More Properties

Despite some consolidation, the trend during the 16-year study period was toward more rather than fewer properties. Table 1 shows that the size of contiguous forest blocks dropped from an average of 979 acres in 1946 to 860 acres in 1962. Change in tract size reflected that of contiguous blocks, but the change was not always proportional because number of tracts did not vary directly with acreage changes.

Most fragmentation took place in the two most heavily forested zones (4 and 5), while the shift in zone 1 between 1946 and 1962 was negligible. The net change in zone 2 was toward consolidation but, like zone 3, which showed evidence of fragmentation, the net change was not large and most of it occurred after 1954.

Although the average size of contiguous blocks and tracts did not change much for the study area as a whole, net shifts in forest zones 4 and 5 were fairly large. The average size decreased by about one-third in both of these zones. Such changes are particularly significant when we consider that zones 4 and 5 include a major share of northern Lower Michigan's timber-growing potential.

Marketing and logging costs can well be affected by the spatial distribution and size of individual tracts of timber. Other things being equal, a 200-acre block of timber would be more economical to harvest than five 40-acre blocks.[4] For one thing, there would be fewer owners to contact and deal with, resulting in lower fixed cost per unit volume harvested. Also, access roads can be laid out more efficiently where large properties are involved. It therefore follows that the cost of harvesting and marketing forest products will increase with an increase in forest land fragmentation.[5]

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[4] *This statement cannot be supported by empirical data, but it is logical and is presumed to be true by wood procurement men.*

[5] *This would hold true up to a point. Where there were few woodland owners, prices for stumpage could conceivably be administered to a level where economies of large-scale logging were offset by high stumpage costs.*

TABLE 1. — *Change in forest acreage in contiguous blocks and tracts, 1946-1962*

Zone (percent of forest[1])	Average number of acres					
	1946		1954		1962	
	Block	Tract[2]	Block	Tract[2]	Block	Tract[2]
1 (40-55)	306	40	306	40	302	40
2 (56-65)	311	54	317	54	371	62
3 (66-75)	1,321	221	1,332	221	1,298	211
4 (76-85)	1,090	317	801	229	699	205
5 (86 plus)	1,230	315	920	235	906	217
Average	979	182	881	164	860	156

[1] *Based on 1955 Forest Survey data.*

[2] *Calculated by dividing the total forest area within contiguous forest blocks by the respective number of contiguous forest tracts.*

To put the concept in economic terms, if ownerships are getting smaller and smaller, the marginal cost curve for each woodlot will shift to the left (fig. 5). Since a timbershed's supply curve represents a horizontal summation of all the producers' marginal cost curves, fragmentation of forest properties would reduce the economic supply of timber. Of course, consolidation of forest land would tend to increase the economic supply of timber products, other things being equal.

Breakup of Large Forest Ownerships Reduced Average Size

The breakup of relatively large forest ownerships accounted for much of the fragmentation between 1946 and 1962 (fig. 6). But the trend toward smaller properties involved all ownership sizes. For example, approximately 36 percent of the change in block size can be attributed to the breakup of medium and small properties.

The breakup of large ownerships does not necessarily mean that we have less acreage in large holdings. What it does mean is that individual large ownerships are not as large now as in 1946. Conceivably we could have more acreage in large forest ownerships, while at the same time having smaller contiguous blocks. Although this was not the case in the study area, the findings suggest that the area in large forest ownerships did not change much during the 1946-1962 period. As the tabulation below shows, the acreage of large ownerships for all zones decreased by only 7 percent between 1946 and 1962:

Zone	*Index of large forest ownership acreage, 1946 = 100*		
	1946	*1954*	*1964*
1	*	*	*
2	100	1,200	4,100
3	100	102	102
4	100	81	17
5	100	62	62
All zones	100	93	93

* *There were no large ownerships in my sample of Zone 1.*

The "all zones" figure, of course, masks out some rather drastic but conflicting shifts. For instance, the 1962 acreage in zone 4 was only 17 percent of the 1946 figure. Zone 5 also exhibited sizable change. But fragmentation of large ownerships in these two zones was nearly balanced by consolidation in zone 2, resulting in only a slight change for the entire study area. On the other hand, the spatial distribution of large ownerships in 1962 differs from that in 1946. Whereas fragmentation involved the breaking up of several large blocks of forest land, the "new" large ownership acreage in zone 2 involves relatively small, scattered tracts.

Change in Block Size Not Related To Farming or Nearness to Cities

One might suspect the change in size of contiguous forest blocks to be related to agricultural activity, since Lake States farm units have been enlarging during postwar years.[6] But more importantly, the intensive

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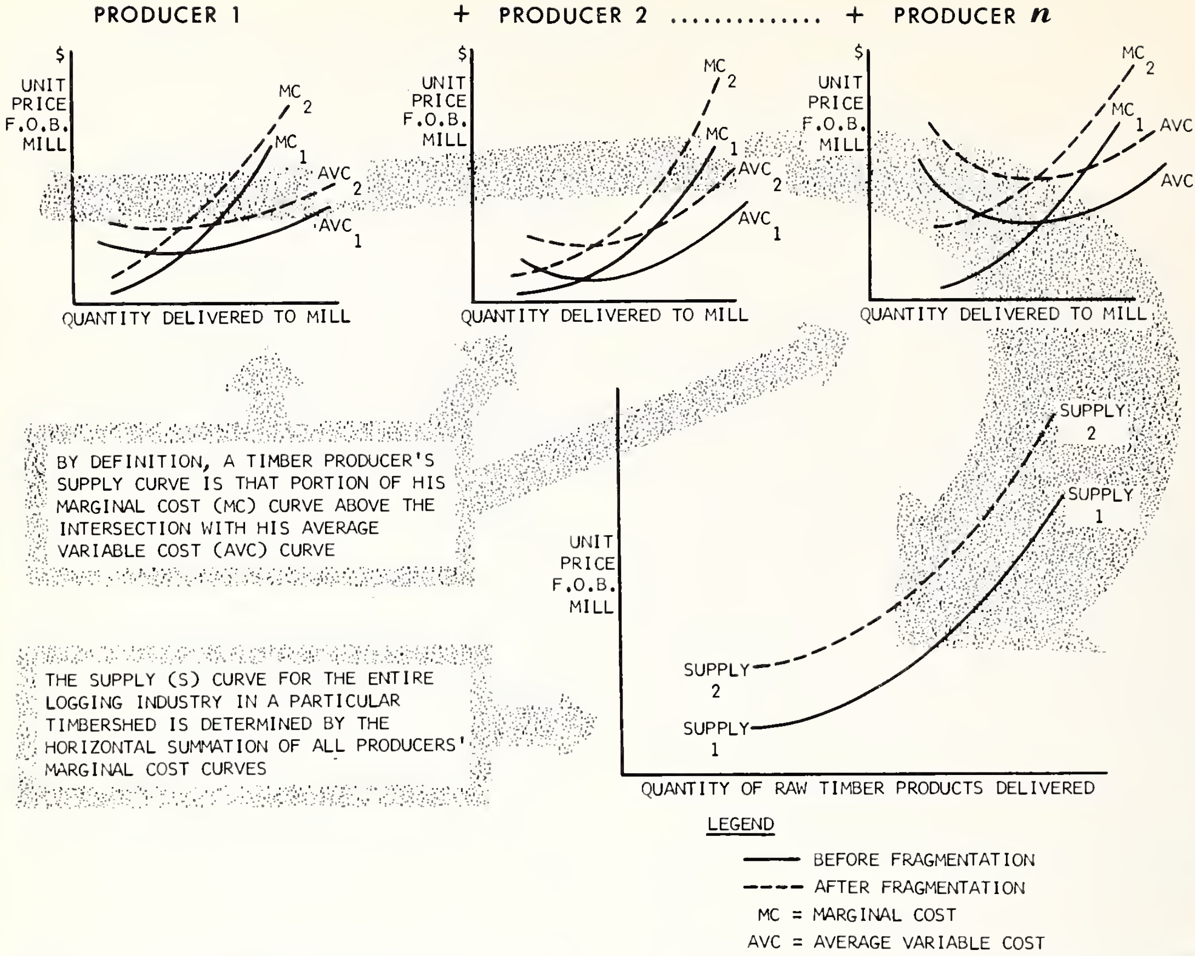
[6] *Dean N. Quinney, and Con H Schallau, Lake States Forest Lands in a Changing Economy.* Land Economics *39(4): 421-427. 1963.*


PRODUCER 1
+ PRODUCER 2 .... + PRODUCER n
$
UNIT PRICE F.O.B. MILL
MC 2
MC 1
AVC 2
AVC 1
QUANTITY DELIVERED TO MILL
SUPPLY 2
SUPPLY 1
QUANTITY OF RAW TIMBER PRODUCTS DELIVERED
LEGEND
BEFORE FRAGMENTATION
AFTER FRAGMENTATION
MC = MARGINAL COST
AVC = AVERAGE VARIABLE COST

BY DEFINITION, A TIMBER PRODUCER'S SUPPLY CURVE IS THAT PORTION OF HIS MARGINAL COST (MC) CURVE ABOVE THE INTERSECTION WITH HIS AVERAGE VARIABLE COST (AVC) CURVE

THE SUPPLY (S) CURVE FOR THE ENTIRE LOGGING INDUSTRY IN A PARTICULAR TIMBERSHED IS DETERMINED BY THE HORIZONTAL SUMMATION OF ALL PRODUCERS' MARGINAL COST CURVES

FIGURE 5. — A hypothetical demonstration of how fragmentation can affect the economic supply of timber. Fragmentation, assuming all other factors constant, causes a shift of producers' (No. 1, No. 2,. .. No. n) marginal cost (MC) curves. This in turn is reflected by the logging industry's supply (S) curve being shifted from S_1S_1 to S_2S_2.

agricultural areas have less forest land and, therefore, less chance for consolidation or fragmentation to occur. The opposite would apply to the extensive agricultural zones.

As logical as this hypothesis might seem, a statistical analysis (table 2) showed no significant relationship between change in size of contiguous forest blocks and agricultural activity as measured by the acreage of cropland harvested (X_4).[7] These results do not rule out the possibility of some forest land consolidation accompanying farm unit consolidation. However, I feel it is safe to say such shifts are unimportant from the aggregate standpoint.

Distance from Interstate Highway 96 (X_7) was used to measure a sample section's proximity to metropolitan Michigan. I thought reduction in size of contiguous blocks might be positively related to distance while consolidation would occur further south where farming is more prevalent. However, table 2 discloses that distance had little or no bearing on fragmentation or consolidation.

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[7] *This as well as other statistical analyses reported here was processed at the Numerical Analysis Center of the University of Minnesota. The CDC UMSTAT 50 program was utilized.*

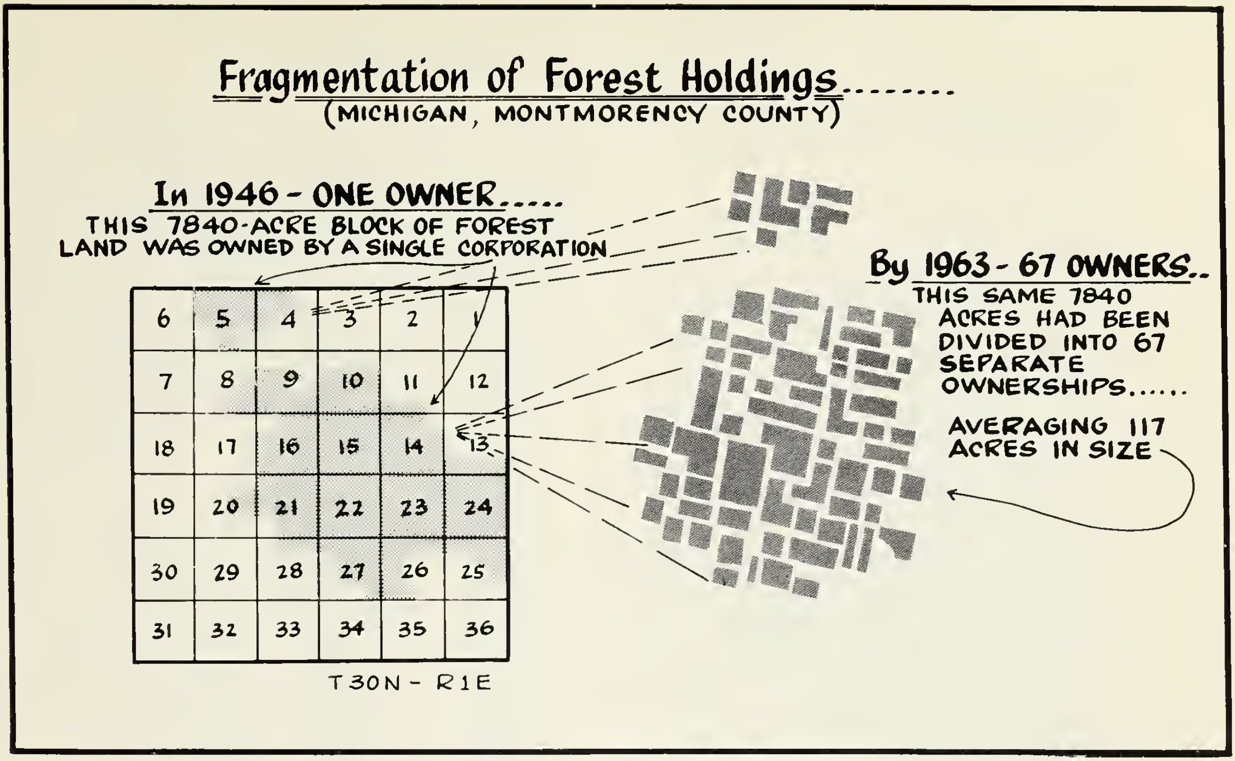
Fragmentation of Forest Holdings........
(MICHIGAN, MONTMORENCY COUNTY)
In 1946 - ONE OWNER.....
THIS 7840-ACRE BLOCK OF FOREST LAND WAS OWNED BY A SINGLE CORPORATION
6 5 4 3 2 1
7 8 9 10 11 12
18 17 16 15 14 13
19 20 21 22 23 24
30 29 28 27 26 25
31 32 33 34 35 36
T30N - R1E
By 1963 - 67 OWNERS..
THIS SAME 7840 ACRES HAD BEEN DIVIDED INTO 67 SEPARATE OWNERSHIPS......
AVERAGING 117 ACRES IN SIZE

FIGURE 6. — The more dramatic 1946-1962 shifts in the size of forested tracts were associated with changes in large forest ownerships. But smaller properties also were broken up into still smaller ones.

Subdivision for Summer Homesites Not Too Important

Before undertaking this study I had observed occasional instances in plat books where forested descriptions had been subdivided into very small tracts. Usually this indicated summer home sites. A statistical analysis shows that subdividing (X_6) was not related to major shifts in size of contiguous forest blocks. Subdivision between 1946 and 1962 didn't account for much of the 1946 forest land base — less than 2 percent of the study area's total acreage.[8]

We have already seen that breakup or consolidation of relatively large forest ownerships was responsible for much of the change in size of contiguous forest blocks. The statistical analysis amplifies this point. The beta coefficients in table 2 show that change in large forest ownership area (X_9) accounted for more variation in change in block size than all other variables tested.

Two other variables were significantly associated with changes in size of contiguous forest blocks: (1) the size of contiguous forest blocks at the beginning of the study period (X_1), and (2) the change in acreage of absentee ownership (X_{10}). At first the relationship between X_1 and the independent variable might appear rather obvious. But until the data were collected and analyzed there was no basis to judge whether one size class of properties (in this case the large ownerships) had an edge or not.

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[8] *Sampling was restricted to forest land as defined by Forest Survey specifications, so this subdivision does not include that taking place within incorporation limits or developed lake frontage as of 1946.*

TABLE 2. — *Factors associated with change in size of contiguous forest blocks (Y), 1946-1962[1]; all forest zones combined*

Multiple correlation coefficient	.6726
Standard error of estimate	610.2630

Independent variable	Regression coefficient	Standard error	Beta coefficient[2]
Constant term	—166.9909		
Size of contiguous forest block in 1946 (X_1)	.0310**	.0127	.1302
Acreage of public ownership in sample section in 1946 (X_2)	.0731	.2122	.0193
Acreage of large private ownership in sample section in 1946 (X_3)	.1985	.6617	.0187
Average acreage of cropland harvested per section in 1959 (X_4)[3]	.1508	.5596	.0126
Acreage of absentee ownership in sample section in 1946 (X_5)	—.1345	.3339	—.0264
Acreage of forest land subdivided for residential or summer home sites between 1946 and 1962 (X_6)	—.5106	1.8930	—.0114
Distance from Interstate Highway 96 (X_7)	.9457	1.7760	.0248
Private forest area as a percent of total land area in 1946 (X_8)	30.8970	20.0910	.1175
Change in large forest ownership acreage between 1946 and 1962 (X_9)	7.6350**	.6412	.5834
Change in absentee ownership acreage between 1946 and 1962 (X_{10})	—1.2523**	.3509	—.1801

[1] *Form of equation used was* $Y = a + b_1X_1 + b_2X_2 \ldots b_nX_n$. *None of the variables was transformed.*

[2] *Cf., Palmer O. Johnson,* Statistical Methods in Research, *Prentice-Hall, New York, 1949, p. 329 . . . "the B's are the partial regression coefficients for the variates expressed in standard measure form, thus rendering them independent of the original units of measurement and giving measures of the comparative weight attributable to each of the independent variates."*

[3] *Magnitude of this variable ranged from 1 to 382 acres per sample section. Township data obtained from Census of Agriculture.*

** *Significant at .01 level.*

Fragmentation Likely to Continue

Because of hunting opportunities, and the demand for outdoor recreation in general, landownership in the study area has become attractive to nonresidents. This interest has led to fragmentation in the past and has also increased land costs. Land acquisition policies of one wood-using firm have been responsible for most forest land consolidation. But because of increased land costs it is doubtful that such companies will want to buy much more land. That fragmentation will continue to determine the trend in size of contiguous forest blocks seems a safe assumption.

Absentee Ownership Likely a Determinant of Timber Availability

For the study area as a whole, acreage of absentee ownership[9] increased about 45 percent between 1946 and 1962 (table 3). Zone 5, the most heavily forested, stands out both in terms of total acreage and absolute change in absentee ownership. But the important observation is that absentee ownership increased in all other zones and at greater rates. For instance, absentee ownership in zone 2 increased by 65 percent but only by 35 percent in zone 5.

TABLE 3. — *Change in acreage of absentee ownership, 1946-1962*
(Acres)

Zone	Absentee ownership per section		
	1946	1954	1962
1	42.5	53.3	67.2
2	79.8	102.0	132.9
3	93.2	111.3	133.0
4	71.5	82.4	107.9
5	185.3	220.1	249.0
All zones	100.0	120.0	144.2

A statistical analysis (table 4) disclosed that the acreages both of large private (X_3) and publicly owned (X_2) forest area in a sample section in 1946 were significantly associated with change in absentee ownership. The negative signs of these two coefficients can be explained by the fact that most private ownership in areas where public and large private ownership predominated in 1946 was already absentee and subsequent changes resulted in an increase of resident ownerships. The analysis also showed change in absentee ownership was more likely in areas where the acreage in large ownerships *changed* (X_{10}). Further, areas having absentee acreage in 1946 (X_5) continued to "attract" the nonresident.

Distance from metropolitan Michigan (X_7) was also associated with change in absentee ownership. The farther a sample section was from the metropolitan areas, the more absentee acreage changed.

The effect of absentee ownership on timber availability is not easy to appraise. Absentee owners are probably less likely than resident owners to be dependent on their forest as a source of income. Perhaps this is one reason why studies have shown the nonresident to be less inclined to market timber. In the Upper Peninsula, for instance, Quinney found that more than 50 percent of forest landowners residing there had harvested timber, whereas only 11 percent of the nonresidents had.[10] In southern Michigan nearly 40 percent of the owners who lived within 10 miles of their wooded tract had harvested timber at least once during their tenure, while only 7 percent of the remaining owners had done so.[11]

One might think that perhaps resident owners have more valuable timber than the absentees and, therefore, are more likely to sell some. But this doesn't appear to be the case. Yoho, for instance, found that, "timber stand conditions have no consistent relationship with owner's distance from property."[12] In fact, the nonresident in southern Michigan had more valuable timber. Only 17 percent lived more than 10 miles from their woodland property, but this group owned 22 percent of the growing stock value.

Certainly, in the short run at least, the tendency for absentee owners to harvest less often may restrict timber supply. But then there is the matter of owner receptiveness to timber management. The experience of some foresters operating in the study area suggests that the nonresident owner is more likely to

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[9] *An owner was judged "absentee" if he lived at least 15 miles from his forest property. I assumed this to be the minimum distance affecting timber sale negotiation.*

[10] *Quinney, Dean N. Small private forest landowners in Michigan's Upper Peninsula. Lake States Forest Expt. Sta., Sta. Paper 95, 20 pp., illus. 1962.*

[11] *Schallau, Con H. Small forest ownership in the urban fringe area of Michigan. Lake States Forest Expt. Sta., Sta. Paper 103, 17 pp., illus. 1962.*

[12] *Yoho, James G. Private forest landownership management in the northern half of Michigan's Lower Peninsula. Mich. State Univ. Agr. Expt. Sta. Tech. Bul. 261. 1957. (See p. 23.)*

Table 4. — *Factors associated with change in absentee ownership (Y) in sample sections between 1946 and 1962; all forest zones combined*

Multiple correlation coefficient	.5997
Standard error of estimate	94.9097

Independent variable	Regression coefficient	Standard error	Beta coefficient
Constant term	15.7873		
Size of contiguous forest block in 1946 (X_1)	.0002	.0020	.0071
Acreage of public ownership in sample section in 1946 (X_2)	—.0914**	.0326	—.1680
Acreage of large private ownership in sample section in 1946 (X_3)	—.1801*	.1024	—.1179
Average acreage of cropland harvested per section in 1959 (X_4)	.0969	.0869	.0056
Acreage of absentee ownership in sample section in 1946 (X_5)	.4728**	.0447	.6458
Acreage of forest land subdivided between 1946 and 1962 (X_6)	.3810	.2936	.0589
Distance from Interstate Highway 96 (X_7)	.5688*	.2745	.1039
Private forest area as a percent of total land area in 1946 (X_8)	—2.6517**	.2767	—.7013
Change in size of contiguous forest blocks between 1946 and 1962 (X_9)	—.0303**	.0085	—.2106
Change in large forest ownership acreage between 1946 and 1962 (X_{10})	.3078**	.1184	.1636

* *Significant at .05 level.*
** *Significant at .01 level.*

subscribe to harvesting and management proposals. Many absentee owners are interested in deer hunting; in fact, this often is the main reason for their owning forest land. Cutting usually improves browse conditions, so such owners occasionally welcome the opportunity to sell timber. Conceptually, in such instances timber products can best be described as "by-products of deer production."

Absentee owners are less likely to be interested in agricultural production. As a result, probably less forest land will be used for crop and pasture purposes as absentee ownership increases.

Property Rights in Forest Land In Continual State of Flux

Forest management is more compatible with stable tenure than rapid turnover, other things being equal. For instance, a person who cannot foresee holding his forest property until it will support a timber harvest isn't likely to be very interested in timber stand improvement or tree planting, unless it clearly improves the value or marketability of his property. Also, the lasting effect of private and public forestry assistance programs is jeopardized by rapid turnover of forest property.

Most privately owned forest land had two owners during the 16-year period (table 5). Sixteen percent of the forest area had three owners. The turnover of forest property was fairly uniform throughout the study area except for zone 4 which had a considerably more rapid turnover.

TABLE 5. — *Percent of forest area in sample section having single or multiple owners during 1946-1962 period*

Zone	One owner	Two identified[1] owners	Three identified[1] owners
1	46	45	9
2	45	44	11
3	40	44	16
4	22	50	28
5	41	40	19
All zones	40	44	16

[1] *I compared owners' names at three points in time — 1946, 1954, and 1962. Chances are most owners' tenure overlapped one of these time periods, but some ownerships that were acquired and sold during intervening years may have been missed. For this reason I feel it best to add the term "identified" when referring to multiple ownerships.*

Discussion and Conclusions

This study has shown private forest-land ownership in the northern half of the Lower Peninsula of Michigan to be very dynamic. The few changes measured are evidence enough. When one considers that these and others are all occurring at the same time and at different rates and in different directions, the situation becomes more involved.

The material presented here may lead the reader to believe that the cost of supplying timber will necessarily increase. I don't want to leave this impression.

For one thing, the forest resources of northern Michigan are staging a comeback. Increased stocking and growth rates should tend to lower harvesting costs per unit volume. In addition, property turnover as well as absentee ownership can sometimes increase the economic supply of timber. If a large forest tract is owned by someone who prefers not to sell stumpage — and there are examples of this — then the breakup of such a property might be good from the timber supply standpoint. At least a few of the new owners might be willing to sell timber.

Cost-decreasing features of the land use changes discussed here might well equal or exceed the cost-increasing side. However, the mere existence of cost-increasing features should challenge foresters and timber users to seek more efficient ways to market and manufacture timber products.

In this study I have merely identified certain forest ownership changes. What these results imply relative to future timber supplies has not been resolved and must be established in later work.

(See page 12 for Appendix)

Appendix: Sampling Accuracy

Table 6 gives an example of the statistical accuracy achieved in this study. Another method used for checking accuracy is to compare estimates with other independently determined values. I was able to make certain comparisons with Forest Survey statistics as follows:

Mean estimate	*Fragmentation study*	*Forest Survey*
Percent of privately owned land that is forested	59.2	61.9
Public ownership as a percent of total land area	24.1	24.3
Large private forest ownership as a percent of total private forest land	4.9	5.7

Table 6. — *Examples of sampling accuracy obtained, all zones combined*
(In acres)

Item	1946		1954		1962	
	$\overline{X}$	$S_{\overline{X}}$	$\overline{X}$	$S_{\overline{X}}$	$\overline{X}$	$S_{\overline{X}}$
Average size of contiguous forest blocks	979	187	881	186	860	181
Large forest-land ownership per section	15	4	14	4	14	4
Absentee ownership per section	100	9	120	9	144	10

Schallau, Con H.
1965. Fragmentation, absentee ownership, and turnover of forest land in northern Lower Michigan. Lake States Forest Expt. Sta., St. Paul, Minn. 12 pp., illus. (U.S. Forest Serv. Res. Paper LS-17)

This report examines three aspects of private forest ownership that could affect the economic availability of timber: size of tract, residence of owner, and turnover rate. Generally speaking, forest properties in northern Lower Michigan are getting smaller. Most postwar fragmentation was associated with the breakup of "large" holdings (i.e., those of more than 5,000 acres). The acreage of forest land owned by nonresidents increased 45 percent between 1946 and 1962. During the same period, turnover of forest properties was fairly rapid, with 60 percent of the ownerships changing hands at least once.

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